

Nest-scale Habitat Use by Pinyon-Juniper Birds on Department of Defense Land

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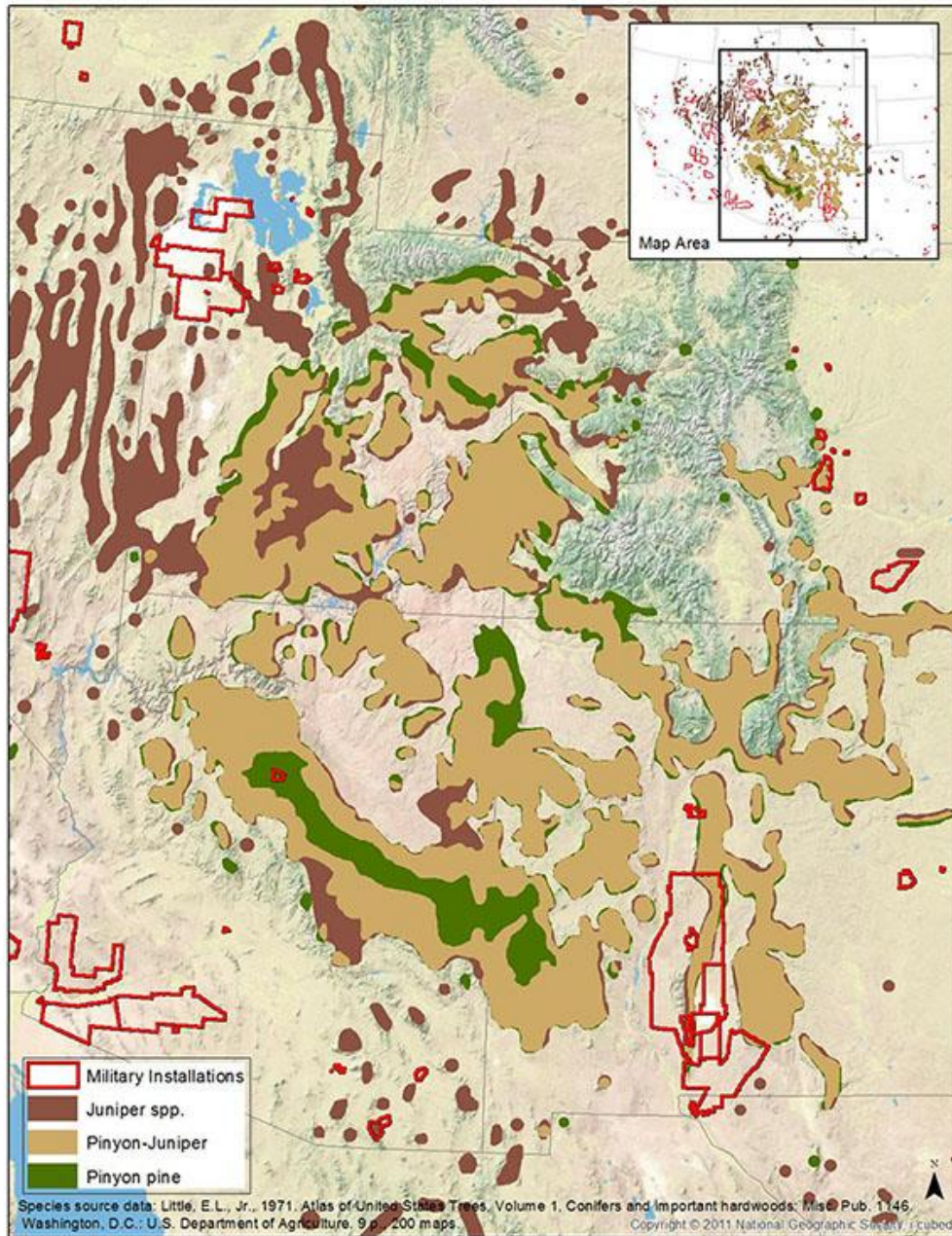
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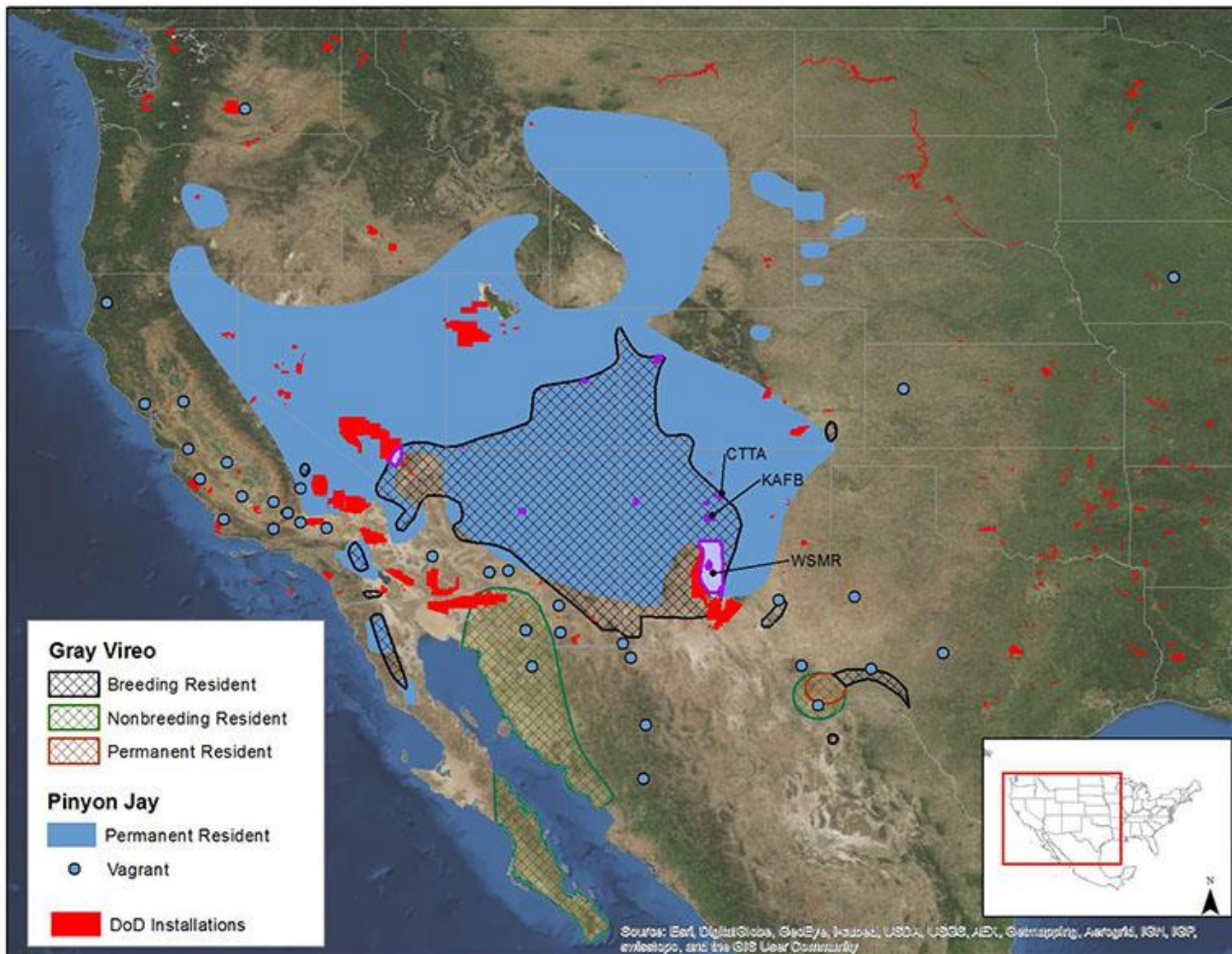
Pinyon-Juniper Woodlands

- ~40 million ha in the West
- Dominant woody vegetation on six DoD installations
- Natural threats = drought, insects, disease, fire
- Climate change is expected to exacerbate threats
- Management threats = grazing, herbicides, thinning, mechanical clearing (for energy exploration, fuelwood exploitation, juniper encroachment)



Wildlife Management and Pinyon-Juniper Woodlands





Gray Vireo (*Vireo vicinior*)

- Short-distance migrant
- Territorial
- Monogamous breeder
- Nest in juniper-dominated habitats through much of their range
- Insectivorous during breeding season
- Host to Brown-headed Cowbird (*Molothrus ater*)



Pinyon Jay

(*Gymnorhinus cyanocephalus*)

- Year-round resident
- Colonial nester
- Cooperative breeder
- Omnivorous; prefers pinyon seeds
- Keystone mutualism with pinyon pine



Study Areas

Kirtland Air Force Base (KAFB)

- 20,359 ha
- 6507 ha pinyon-juniper

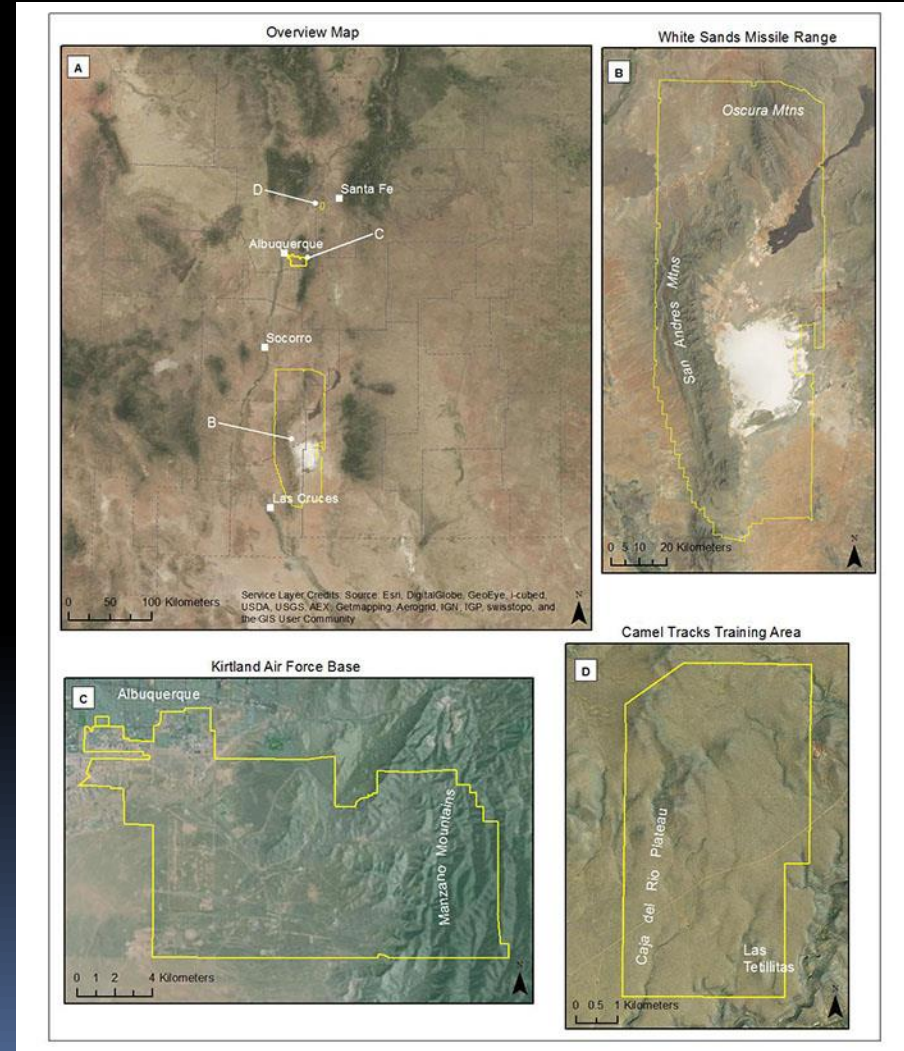
White Sands Missile Range (WSMR)

- 885,910 ha
- 54,100 ha pinyon-juniper

Camel Tracks Training Area (CTTA)*

- 3345 ha
- 1200 ha pinyon-juniper

*Gray Vireos only



Field Methods



Nest/Random Plot Measurements

Field measurements

- Nest height, aspect, dist. to tree edge, no. branches
- Nest tree height, width of foliage
- Tree composition, density, height, canopy cover, size class (jays only), and root crown diameter (jays only)
- Shrub composition and density
- Ground cover

Derived (GIS) measurements

- Elevation, slope, aspect, curvature (vireos only)
- Distance to nearest road, building

Statistical Analyses

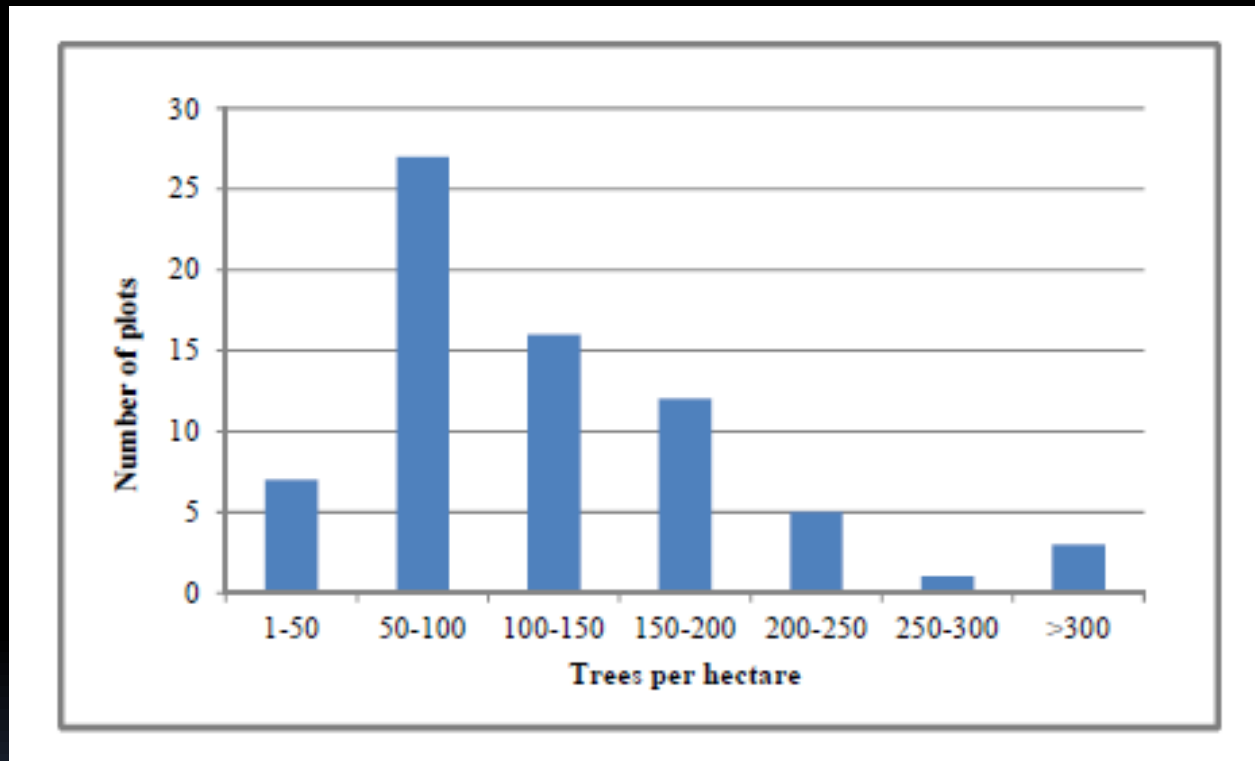
- Conditional logistic regression
- Tested variables for correlation
- Global models: topographic, vegetative, military infrastructure variables
- Built final model set
- AICc to evaluate models
- Area under the curve (AUC) to assess discriminatory power of models

Summary Results – Gray Vireo

- Gray Vireos nested in juniper-dominated woodlands
- 89 total nests; 18 renesting attempts
- Randomly selected 1 nest per territory per season
- 71 nests included in analyses
 - CTTA = 16
 - KAFB = 34
 - WSMR = 21



Tree Density – Gray Vireo



Tree density ranged from 25–425 trees/ha (mean=99).

Most plots had fewer than 200 trees/ha.

Candidate Model Set – Gray Vireo

Topographic

Elevation, Aspect, Curvature

Vegetative

Tree Density, Mean Tree Height, Canopy Cover, Shrub Density, Live Ground Cover

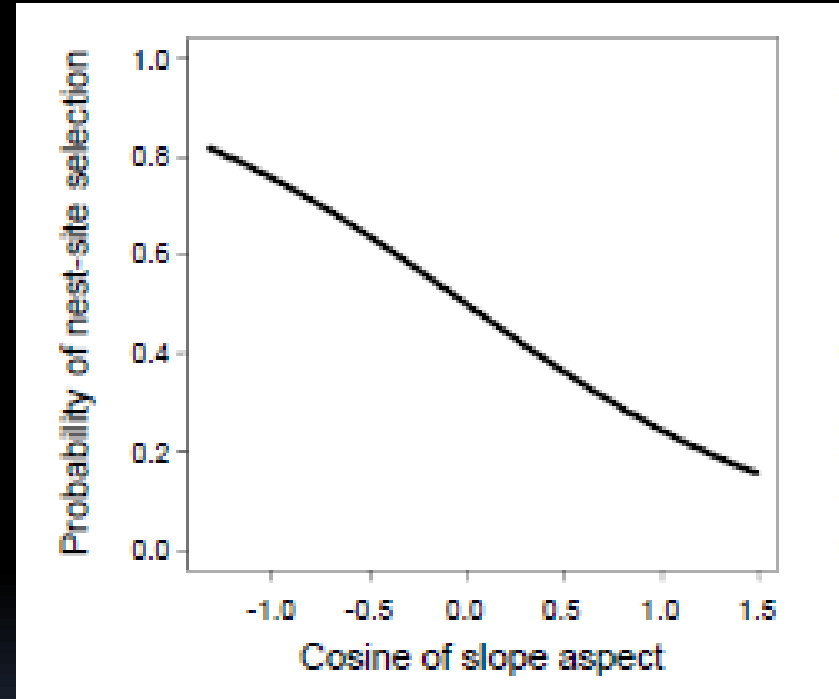
Infrastructure

None were discriminatory, but vireos showed slight avoidance of buildings at one installation (CTTA).

Model	k	-LL	AIC _C	ΔAIC _C	w _i	AUC
Cos_Aspect+No.Trees+MeanTreeHt	4	-37.047	82.385	0.000	0.510	0.819
Cos_Aspect+Curve+No.Trees+MeanTreeHt	6	-35.254	83.130	0.745	0.351	0.843
Curve+No.Trees+MeanTreeHt	5	-37.493	85.427	3.042	0.111	0.810
Cure+MeanTreeHt	4	-41.501	91.293	8.908	0.006	0.752
Cos_Aspect+Curve+MeanTreeHt	5	-40.443	91.327	8.942	0.006	0.784
Cos_Aspect+Curve+No.Trees	5	-40.549	91.539	9.154	0.005	0.776
Curve+No.Trees	4	-42.039	92.370	9.985	0.003	0.743
MeanTreeHt	2	-44.720	93.526	11.141	0.002	0.708
Cos_Aspect+MeanTreeHt	3	-44.111	94.396	12.011	0.001	0.713
Cos_Aspect+No.Trees	3	-44.405	94.983	12.598	0.001	0.715
No.Trees	2	-45.784	95.655	13.270	0.001	0.685
Curve	3	-44.787	95.747	13.362	0.001	0.685
Cos_Aspect+Curve	4	-44.126	96.544	14.159	0.000	0.708
No.Trees+MeanTreeHt	4	-44.126	96.544	14.159	0.000	0.708
NULL	1	-49.213	100.455	18.070	0.000	0.500
Cos_Aspect	2	-48.827	101.741	19.356	0.000	0.539

Nest Site Selection – Gray Vireo

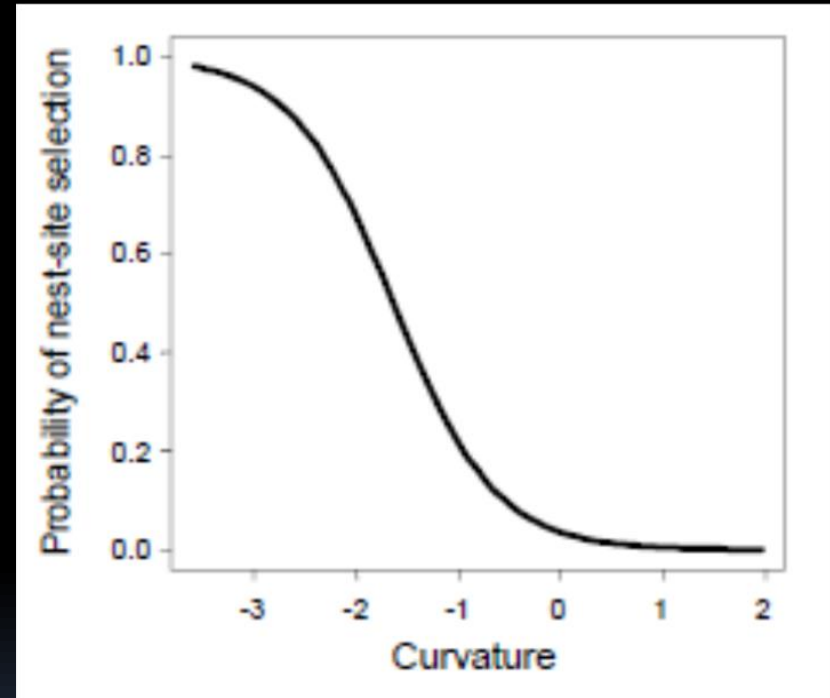
- South-facing aspects*
- Slightly negative (bowl-shaped) curvature
- More trees
- Taller trees



*DeLong and Cox (2005) reported Gray Vireos nested at more west-facing aspects in Socorro and Santa Fe, NM.

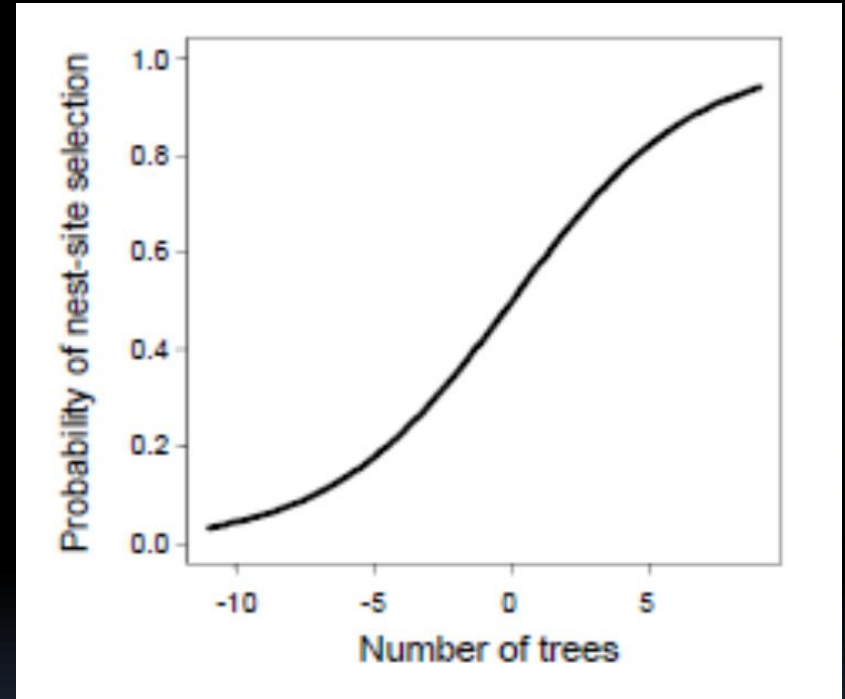
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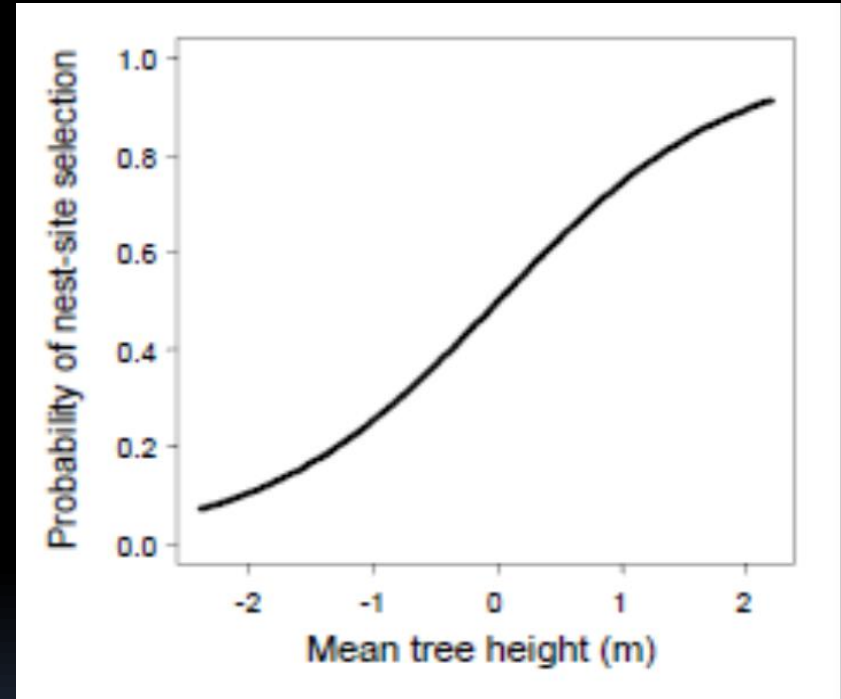
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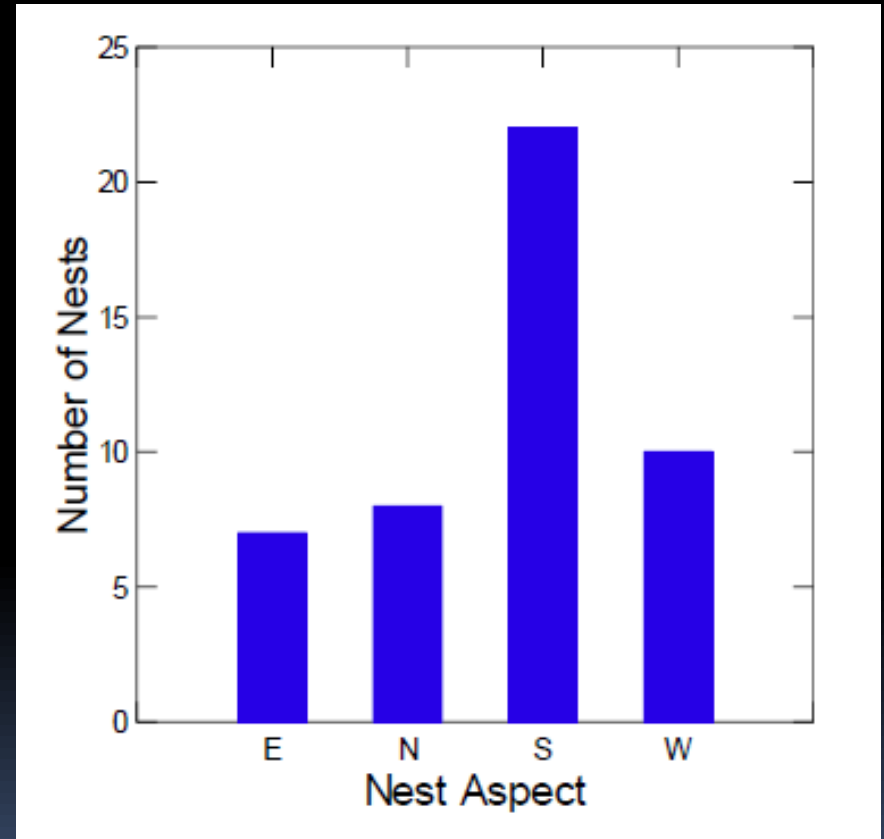


Nest Site Selection – Gray Vireo

At KAFB, nest aspect was not equally distributed ($\chi^2=12.319$, $df = 3$, $P = 0.006$)

47% of nests were south-facing

Nest aspect not important to daily nest survival



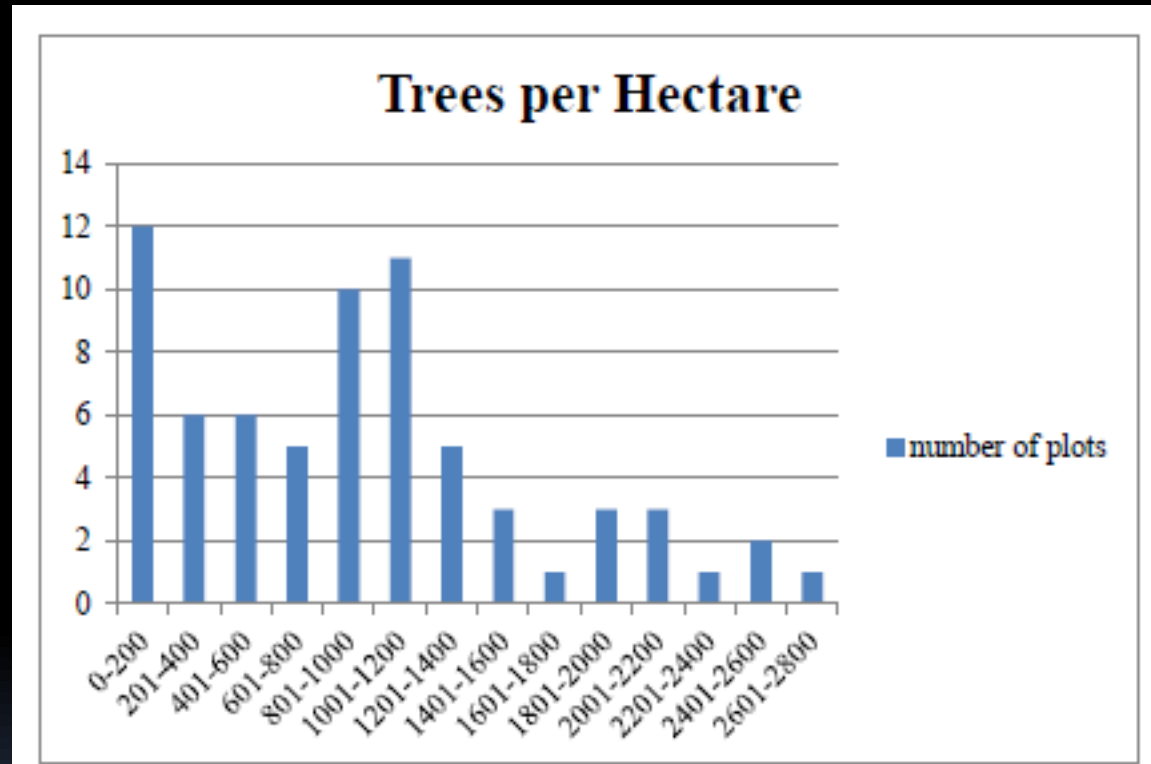
Summary Results – Pinyon Jay

- 97 total nests
 - KAFB = 57
 - WSMR = 40



- Pinyon Jays nested in pinyon-dominated and pinyon-juniper woodlands
- At KAFB, one colony overlapped vireo territories and nests were in junipers

Tree Density – Pinyon Jay



Tree density ranged from 25–2,725 trees/ha (mean=965).

Most common tree size class was medium (7–21 cm root crown diameter).

Candidate Model Set – Pinyon Jay

Vegetative

Canopy Cover, Root-crown Diameter, Ground Cover (forb, shrub, litter), Tree Size Class, Tree Height

Topographic

No variables discriminatory

Infrastructure

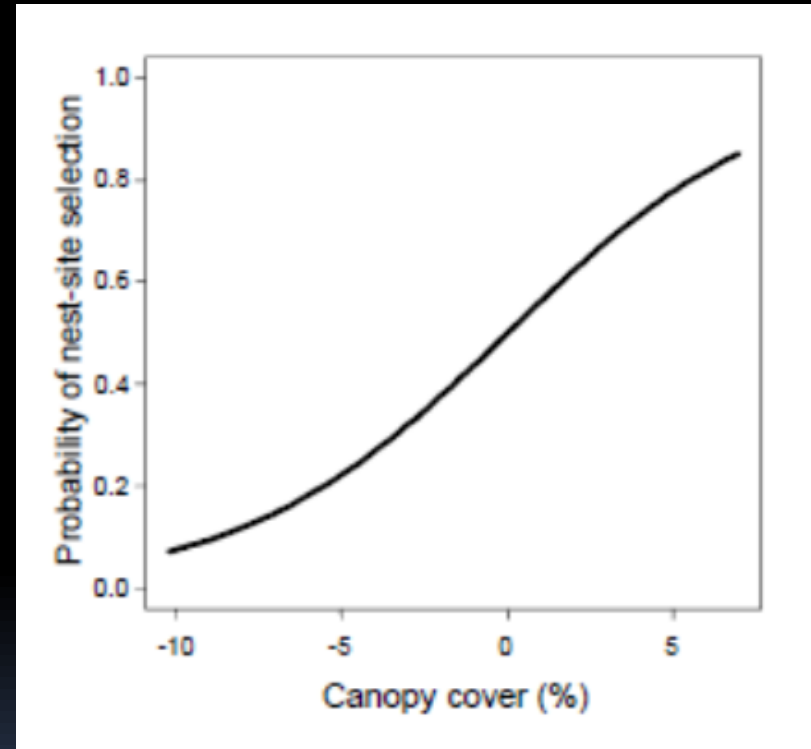
No variables discriminatory

Model Selection – Pinyon Jay

Model	k	-LL	AIC _c	ΔAIC _c	w _i	AUC
Canopy+LogTreeRCD+Litter	4	-95.296	198.803	0.000	0.716	0.772
Canopy+LogTreeRCD	3	-97.611	201.348	2.546	0.201	0.744
Canopy+LogTreeRCD+TreeHt	4	-97.463	203.138	4.335	0.082	0.745
Forb+Forb ² +Shrub+Shrub ² +Litter+Litter ² + Canopy+Canopy ² +LogTreeRCD+ LogTreeRCD ² +TreeHt+TreeHt ² +SmTrees+ SmTrees ² +LgTrees+LgTrees ²	17	-87.450	212.377	13.574	0.001	0.808
AllShrub+AllForb+AllLitter	4	-102.960	214.132	15.330	0.000	0.718
SmallTrees+LargeTrees	3	-112.355	230.837	32.035	0.000	0.624

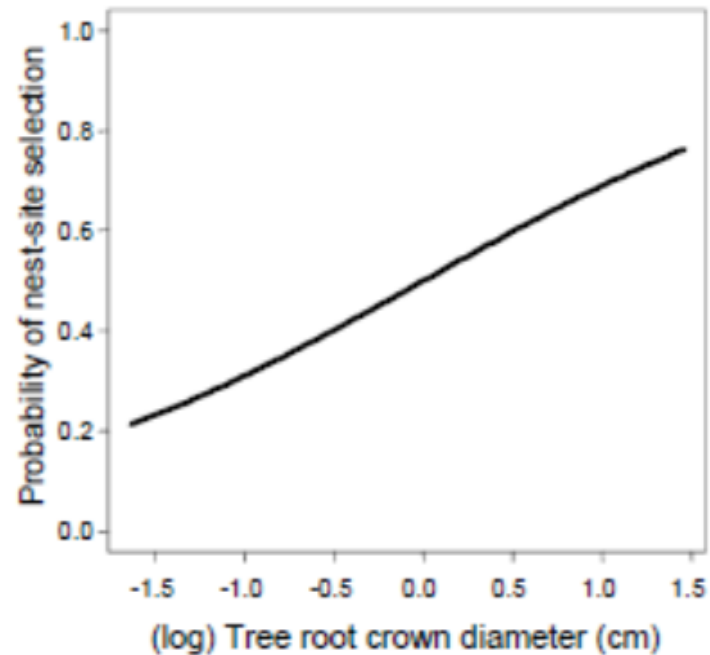
Nest Site Selection – Pinyon Jay

- Higher canopy cover
- Greater root-crown diameter
- More litter



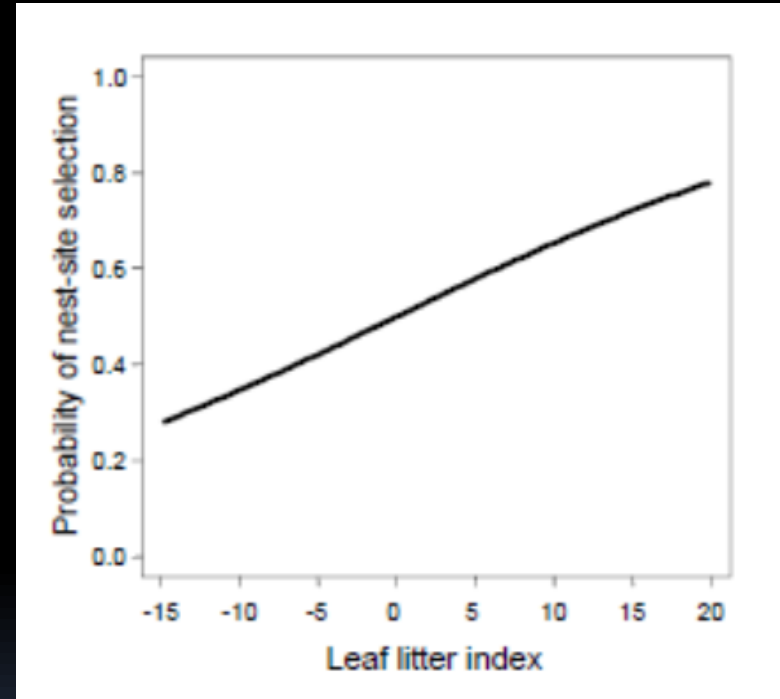
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Management Recommendations



Management of Pinyon Jay habitat probably most effective at the landscape level

Management of Gray Vireo habitat probably more effective at the territory and nest scale

Military Infrastructure

Neither Gray Vireos nor Pinyon Jays showed a strong preference or avoidance to placing their nests near roads, buildings, and occasional loud noises

Gray Vireos rarely abandoned nests, suggesting they tolerate some disturbances by humans

Pinyon Jays were sensitive to human approach

Tree Size, Density, and Canopy Cover

Gray Vireos selected nest sites with more and taller trees

Pinyon Jays selected nest sites with greater canopy cover and root-crown diameter

These preferences may = predator avoidance

Retain large juniper trees in Gray Vireo nesting areas

No net loss of mature, healthy pinyon stands

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